NON-PUBLIC?: N
ACCESSION #: 9302020444
LICENSEE EVENT REPORT (LER)

FACILITY NAME: CRYSTAL RIVER UNIT 3 (CR-3) PAGE: 1 OF 04

DOCKET NUMBER: 05000302

TITLE: Binding of Main Feedwater Pump Control Actuator Results in Feedwater Flow Reduction, Emergency Feedwater Actuation, and Reactor Trip Due to High Coolant System Pressure
EVENT DATE: 12/29/92 LER #: 92-027-00 REPORT DATE: 01/27/93

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: W. A. Stephenson, Nuclear Safety Supervisor TELEPHONE: (904) 795-6486

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: JK COMPONENT: 0065 MANUFACTURER: W290
REPORTABLE NPRDS: Yes

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On December 29, 1992, Crystal River Unit 3 was operating in MODE 1 (POWER OPERATION) at 100% of RATED THERMAL POWER. At 04:16:16, the plant tripped due to high Reactor Coolant System (RCS) pressure caused by inadequate Main Feedwater (MFW) flow to the "B" Once Through Steam Generator. Binding of the "B" MFW Pump (MFWP) turbine control actuator caused the pump speed to decrease, resulting in a reduction in MFW flow on the affected side. RCS pressure increased to the high pressure trip setpoint due to inadequate primary-to-secondary heat transfer.

Internal binding was caused by a buildup of deposits in the pump control actuator combined with normal wear of internal parts. External binding was the result of rubbing between two actuator components. The MFWP oil

accumulators were purged several times. Control oil filters were replaced. The MFWP actuator was replaced and the linkage arm was cleaned and reassembled. Florida Power Corporation (FPC) is establishing a preventive maintenance (PM) program to replace the MFWP turbine control actuators and rebuild the actuator linkage every six years. FPC is also evaluating the need for a PM program to clean the associated oil systems on a periodic basis.

END OF ABSTRACT

EVENT DESCRIPTION:

On December 29, 1992, Crystal River Unit 3 (CR-3) was operating in MODE 1 (POWER OPERATION) at 100% of RATED THERMAL POWER (RTP). At 04:16:16, the
plant tripped due to high Reactor Coolant System (RCS) AB! pressure. The high pressure condition was caused by inadequate Main Feedwater (MFW) SJ! flow to the "B" Once Through Steam Generator (OTSG) AB,SG!. At 04:17:01, the Emergency Feedwater (EFW) system BA! actuated due to low level in the "B" OTSG.

The MFW system at CR-3 consists of two trains of equipment, typically referred to as the "A" and "B" trains. Each train includes one turbine driven MFW Pump (MFWP) SJ,P!. Above 60% of RTP, the pump outlets are separated, with each MFWP feeding an OTSG. The Integrated Control System JA! regulates flow to the OTSGs by adjusting MFWP speed. At 04:15:56, the "B" MFWP speed began to decrease rapidly, causing a dramatic reduction in the "B" train MFW flow. Over the course of the next four seconds, MFW flow to the "B" OTSG decreased from 5.3 x 10**6 lb sub m/hr to approximately no flow.

It is important to note that approximately three seconds into the event, one of two "B" train MFW flow instruments SJ,FT! failed high. The Smart Automatic Signal Selection (SASS) system I! sensed this failure and initiated an alarm of the condition. At this same point in time, Channel "B" of the ATWS Mitigation and Control (AMSAC) System I! tripped, resulting in a half-trip of both EFW Initiation and Control (EFIC) BA! system trains. The AMSAC system actuation and its accompanying alarm, together with the SASS system alarm, provided the first indications that a problem existed with MFW flow. Since the degraded flow condition only existed in one of the two feedwater trains, the AMSAC system did not initiate a full EFIC actuation per design.

As the "B" side MFW flow decreased, level in the "B" OTSG diminished and

RCS pressure began to increase rapidly. The pressurizer spray valve SJ,20! opened automatically, however, the flow through the valve was insufficient to terminate the RCS pressure excursion. At 04:16:16, twenty seconds after the "B" MFWP began losing speed, the Reactor Protection System (RPS) JC! automatically tripped the reactor on high RCS pressure.

At 04:17:01, or approximately forty-five seconds after the reactor trip, level in the "B" OTSG had decreased to the low level setpoint of the EFIC system, resulting in an actuation of both trains of the EFW system. Both EFW pumps BA,P! started automatically and began supplying inventory to the "B" OTSG.

In response to the reactor trip, control board operators began performing the immediate actions required by plant procedures. While engaged in these actions, one of the operators noticed that the "B" side MFW flow indication was excessively high. Since the EFW system was supplying adequate inventory to the OTSGS, the

operators tripped both MFWPs in accordance with plant procedures. This occurred approximately one minute and twenty seven seconds following the reactor trip.

Less than nine minutes after the reactor trip, plant conditions had stabilized. Level in the "B" OTSG had recovered and the EFIC system was controlling inventory in both OTSGS. At approximately twenty-five minutes after the trip, the operators restarted the "A" MFWP. After verifying that the MFWP was feeding both OTSGS, operators secured the EFW pumps.

The event was reported to the Nuclear Regulatory Commission at 05:01 via the Emergency Notification System per the requirements of 10CFR50.72(b)(2)(ii). This report is submitted in accordance with 10CFR50.73(a)(2)(iv).

EVENT ANALYSIS:

All protective systems functioned as designed. The RPS tripped the reactor, and the EFIC system actuated and controlled OTSG inventory. All actuations occurred at or before the required setpoints. Operator actions were appropriate and in accordance with plant procedures. Plant parameters stabilized at normal post-trip values.

CAUSE OF EVENT:

The "B" MFWP lost speed due to internal and external binding of the Woodward Model No. EG-3P turbine control actuator SJ,65!. As pump speed decreased, pump flow and discharge pressure decreased. Once the discharge pressure of the pump decreased to a value below the OTSG pressure, the pump was unable to feed the OTSG. RCS pressure increased rapidly as a result of inadequate primary-to-secondary heat transfer. The RPS tripped the reactor prior to system pressure exceeding the high RCS pressure limiting safety system setting.

The internal binding was most likely caused by a buildup of deposits in the MFWP actuator combined with the wearing of internal parts. Such buildup and wear is to be expected during normal pump operation. It is also possible that some debris or dirt from previous work on the control oil system got caught in the actuator piston or orifices. New accumulators were installed on the control oil system during the plant's last refueling outage. Dirt trapped inside an accumulator may have intruded into the control oil system, and eventually into the actuator, thus causing it to stick and be erratic. The vendor noted that this situation has occurred at other facilities. The vendor has been requested to perform a failure analysis on the actuator as an added attempt to determine the primary cause of the internal binding. The external binding was the result of rubbing between two actuator components.

CORRECTIVE ACTION.

The MFWP control oil accumulators were purged several times. Control oil filters SL,FLT! were replaced. Plant personnel replaced the MFWP control actuator and cleaned, repaired, and reassembled the actuator linkage.

As a result of this event, FPC is implementing a preventive maintenance (PM) program which will periodically replace the MFWP control actuators and rebuild the actuator linkage. This work will be scheduled to run concurrent with the MFWP turbine overhaul that is conducted every six years. Although there was no conclusive evidence of excessive particulate concentration in the "B" MFWP control oil system, FPC is evaluating the installation of oil filters exhibiting a smaller particulate rating than that presently used. The oil sampling point is also being assessed for acceptability. Additionally, FPC is evaluating the implementation of a PM program which would require a cleanup of the MFWP oil systems SL! on an established periodic basis.

PREVIOUS SIMILAR EVENTS:

A similar event occurred in 1983. In that particular situation, dirty control oil caused the "A" MFWP to control erratically.

ATTACHMENT 1 TO 9302020444 PAGE 1 OF 1

Florida
Power
CORPORATION

Crystal River Unit 3
Docket No. 50-302

January 27, 1993
3F0193-12

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Subject: Licensee Event Report (LER) 92-027

Dear Sir:

Enclosed is Licensee Event Report (LER) 92-027 which is submitted in accordance with 10 CFR 50.73.

Sincerely,

G. L. Boldt
Vice President
Nuclear Production

EEF:mag

Enclosure

xc: Regional Administrator, Region II
Project Manager, NRR
Senior Resident Inspector

POST OFFICE BOX 219 * CRYSTAL RIVER, FLORIDA 32623-0219 * (904) 795-6486
A Florida Progress Company

*** END OF DOCUMENT ***